Teaching Database Systems at the Faculty of Informatics at the University of Debrecen

István Juhász, Márk Kósa, Anikó Vágner

University of Debrecen
Faculty of Informatics
juhasz.istvan@inf.unideb.hu
kosa.mark@inf.unideb.hu
vagner.aniko@inf.unideb.hu

Abstract

The Bologna system has been introduced at the Faculty of Informatics at the University of Debrecen by the launch of the Software Engineering BSc major. The first students of this major graduated in 2007. The Software Engineering MSc major started in the same year, and the first MSc students graduated in 2009. Based on the experience of the first BSc major, the system of subjects and knowledges has been revised.

In the bachelor’s program, the discipline of Database Systems is represented by two compulsory subjects and one elective subject block. In the master’s program one subject is compulsory. Additionally, in two specializations further elective subjects are at the students’ disposal.

In this paper, we present the state and teaching experience of database knowledge in the frame of the Software Engineering BSc and MSc programs. We also respect some didactic questions.

Keywords: Database systems, subjects, curriculum.

MSC: 97Q99

1. Introduction

The Software Engineering BSc major started in 2004 at the Faculty of Informatics at the University of Debrecen. The first revision of this major took place in 2007. Since then there are two compulsory subject in the field of database systems: Database Systems and Database Administration. An elective subject block is based on these subjects from which the students have to choose one subject compulsorily but they may register further subjects in order to obtain the required credits.
The Software Engineering MSc major started in 2007 at the faculty. The program provides a broad technical understanding of current and evolving technologies in the IT field with an emphasis on moving technology from the laboratory to the realm of business development through its program core courses. In this major, there is only one compulsory subject in the field of database systems: *Data and System Models*. The elective subjects are compulsory in some specializations. In other specializations, students can choose these subjects as elective subjects. In addition to the basic course, there is opportunity to study distributed databases, data warehousing, data mining, database administration, and database security. Laboratory experiences are included in most courses.

In the following, we show the topics all of these subjects as well as some practice materials which can be used during the practice courses throughout the entire curriculum from the first compulsory subject to all of the elective subjects.

2. Subjects in the Field of Database Systems

2.1. Database Systems

Type of subject: compulsory; prerequisite: *Programming Languages 1*; number of lecture and practice hours per week: $2 + 2$; credit: 5.

The main goal of this subject is to present the concept of the three most important basic data models: the relational, the entity-relationship, and the object model. In practice courses, we use the SQL language to manage relational databases.


We have created a couple of database schemas that can be used in the practice courses of each subject mentioned in this paper. You can see one of these schemas in Figure 1. These schemas can be used by students to learn all the knowledge related to the subjects described in the previous section.

These schemas can be downloaded from the homepage of Database Systems, while test questions regarding these schemas are available on the homepages of the different subjects. In Figure 2, you can see simple questions and answers related to the schema in Figure 1.
2.2. Database Administration

Type of subject: compulsory; prerequisite: *Database Systems*; number of lecture and practice hours per week: 2 + 0; credit: 3.

The main goal of this subject is to present the basics of database administration, i.e. the concepts, tasks, and methods used when operating databases.

**Topics:** The concept of database administrator. DBA tasks. Creating the database environment. Metadata management. Data and storage management. Data movement and distribution. Database security. Database backup and recovery. Disaster planning. Data availability. Performance. Database change management. The topics are discussed in particular DBMSs.

2.3. Database System Implementation 1

Type of subject: elective; prerequisite: *Database Systems*; number of lecture and practice hours per week: 2 + 0; credit: 3.

The main goal of this subject is to present the algorithms and methods related to logging and concurrency control used by DBMSs in general and Oracle in particular.


2.4. Database System Implementation 2

Type of subject: elective; prerequisite: *Database System Implementation 1*; number of lecture and practice hours per week: 2 + 0; credit: 3.

The main goal of this subject is to present the algorithms and methods related to query compilation, execution, and SQL tuning used by DBMSs in general and Oracle in particular.

2.5. Advanced DBMS Studies 1

Type of subject: elective; prerequisite: Database Systems; number of lecture and practice hours per week: 2 + 2; credit: 5.

This subject combines the declarative SQL with procedural language elements. The lecture and the practice are closely connected. The main goal of this subject is to introduce students to Oracle application development.


2.6. Advanced DBMS Studies 2

Type of subject: elective; prerequisite: Advanced DBMS Studies 1; number of lecture and practice hours per week: 2 + 2; credit: 5.

The lecture and the practice are closely connected. The main goal of this subject is to develop the object-relational database application development approach. The student use PL/SQL and Java in the practice courses.


2.7. Data and System Models

Type of subject: compulsory; prerequisite: none; number of lecture and practice hours per week: 2 + 2; credit: 6.

This subject is a basic subject in the master’s program. The main goal of this subject is to give the students a common approach in the field of database systems. The subject summarizes the knowledge about database systems that students had learnt during their previous studies. In the practice courses, students make concrete database schemas using various modeling techniques.

Some theoretical issues and current problems of data modeling. Modeling of informa-
tion systems (environment, behavior, data and object models). XML as a
general model and as a standard communication tool. Web-modeling.

2.8. Database Security

Type of subject: elective; prerequisite: Data and System Models; number of lecture
and practice hours per week: 0 + 2; credit: 2.

The main goal of this subject is to present security problems, policies, and
standards regarding databases.

Topics: Security and tuning of databases. Managing network communication,
services, and remote users. Backup and recovery of databases. Data protection
policies and their applications. Automated data management processes. Security
objects and policies. DSM, DAC, Mandatory Security Model, Multilevel Secure.
Managing integrity. Consistency control.

2.9. Advanced Database Technologies

Type of subject: elective; prerequisite: Data and System Models; number of lecture
and practice hours per week: 0 + 2; credit: 2.

The main goal of this subject is to present the concepts of native XML data-
bases. The students use Xquery and Xpath as well as Oracle, eXist, and Sedna
DBMSs.

Topics: Native and nested XML databases. XQuery and XForm. Generic
architecture for storing XML documents in relational databases. XML based data
warehouses. Creating XML based web pages in database environment. Comparing
efficiencies. Building portals. Web service development. XML based reusable com-
ponents. Using OO languages for developing database applications. Application
servers. Frameworks.

References

[1] Gábor András, Juhász István, Kollár Lajos, Oracle a Debreceni Egyetem Matematikai
és Informatikai Intézetében, Informatika a felsőoktatásban 2002, Debrecen.

[2] Hajas Csilla, Fazekas Gábor, Juhász István, Az adatbázis rendszerek oktatása a KLTE-

[3] Juhász István, Gábor András, Teaching database systems at the Institute of Informatics of the University of Debrecen, 6th International Conference on Applied Informatics,

oktatásának tapasztalatai a Debreceni Egyetem Informatika Karán, Informatika a felsőoktatásban 2008, Debrecen.

[5] Subjects managed by the Department of Information Technology,
http://it.inf.unideb.hu/honlap/Tantárgyak

[7] Curriculum of the Software Engineering BSc program,

István Juhász
Márk Kósa
Anikó Vágner
University of Debrecen
Faculty of Informatics
H–4032
Egyetem tér 1.